Effect of Combined Probiotics (*Saccharomyces cerevisae + Candida utilis*) and Herbs on Carcass Characteristics of Swamp Buffalo

P Mahyuddin* and Y Widiawati

Indonesia Research Institute for Animal Production, Jl. Veteran 3, Ciawi, PO Box 221 Bogor 16002, Indonesia
***Corresponding author email : pmahyuddin@yahoo.com**

Abstract. A feedlot trial was conducted to study the effect of probiotics + herbs on carcass characteristics. Thirty male swamp buffaloes aged 2–2.5 years with the average body weight of 297 kg were used in this trial. They were fattened for 75 days to reach a slaughter weight of around 350–400 kg. They were divided into two groups of 15 animals in each group, and were placed in a shaded paddock. The groups were the control and the treated animals. The treated animals were given a supplementation containing combined yeasts (*Saccharomyces cerevisae* and *Candida utilis*), and herbs. All animals were fed basal diet of ammoniated rice straw and commercial concentrate with a ratio of 10: 90. There was no effect of probiotics+herbs on live weight gain, percentage of carcass, dressing, meat and by products, back fat thickness and eye muscle area. Addition of probiotics+herbs increased proportion of bone, reduced meat : bone ratio, body fat and proportion of offal. Although body fat content was reduced by the treatment, the compositions of fat were similar between the control and treated animals.

Key Words: buffalo, feedlot, yeast, carcass

Introduction

The use of yeast culture as an alternative to antibiotics growth promoters in ruminant diets has gained great interests of both researchers and farmers because the concern of using antibiotics in food-producing animals that could result in the presence of residues in milk, meat and other animal products consumed by humans. Many studies have demonstrated the ability of yeast culture to stimulate rumen microflora and to optimize rumen function. Animals on high energy diet such as high-producing dairy and finishing beef cattle or feedlot animals may get benefit from the addition of yeast culture in the diet by preventing the accumulation of lactic acid in the rumen thus improve digestion and could also improve intake. Several modes of action have been proposed regarding their stimulatory effects on ruminal fermentation (Baeuchemin et al., 2003; Chaucheyras-Durand et al., 2008)

Growth responses to yeast supplementation were found to be vary, even with the same yeast culture preparation, the responses may range from lack of effect to positive effect (Desnoyers, 2009). Feeding yeast culture has no effect on dry matter intake (DMI), live weight gain (LWG) or feed conversion ratio (FCR) of steers (Cabrera et al., 2000, Gomes et al., 2009), male dairy calves (Titi et al., 2008b) or finishing lambs (Kawas et al., 2007a; 2007b; Titi et al., 2008a) and kids (Titi et al., 2008a), goats (Whitley et al., 2009) or buffalo calves (Saijpaul et al., 2007; Ramirez et al., 2007). However, Haddad et al. (2005) and Tripathy et al. (2010) found supplementation of yeast culture in lambs increased LWG, but increased DMI, and DM digestibility observed by Haddad et al. (2005) were not observed by Tripathy et al. (2010). In neonatal dairy calves, Lesmeister et al. (2004) found that supplementation of 2% of yeast culture in the starter diet improved DMI and LWG. Increased DMI, LWG and FCR were found in goats (Yong and Paengkoum, 2009) supplemented with combined yeast + *Lactobacillus acidiphilus*. In mid-lactation dairy cows, supplementing yeast culture in the diet increased DMI and milk yield (Moallem et al., 2009). Yeast culture offered to buffalo calves also improved DMI but no LWG was reported (Bakr et al., 2009).

The effects of yeast culture on carcass characteristics were also variable; no improvement of carcass traits and meat quality of feedlot finished steers (Gomes et al., 2009), or finished goats were found (Whitley et al., 2009; Titi et al., 2008a). Addition of yeast culture in finishing diet reduced meat/bone ratio and tissue protein in lambs and goats,

increased fat content in lambs but not in goats (Titi et al., 2008a). There is no study being carried out to investigate the effect of yeast culture in feedlot buffalo. In South East Asia, the smallholders have been using herbs as feed supplements to prevent or cure animal diseases. The popular one is *Curcuma sp* which contain antibacterial cucurmine and *Alpina galanga* which is believed to improve appetite. Therefore this paper reports the effect of combined yeast culture and herbs supplementation in finishing diet on carcass traits of buffalo.

Materials and Methods

Animals, experimental procedures and treatment diets

Thirty intact male swamp buffaloes aged 2–2.5 years were divided into 2 groups using stratified body weight (BW). Each group (15 animals) was placed in a shaded paddock for 75 days to reach a slaughter weight of 350–400 kg. The groups were the control and the treatment. All animals received the same ration (Table 1) ad libitum 2 times a day. At the start the animals were offered a diet consisting of 1:1 (ammoniated rice straw : concentrate) and gradually this ratio was increased to 1:9. The treatment group was offered with an additional probiotics and herbs as supplement. Total of the feed offered and refused were recorded daily.

Table 1. Dietary ingredients and composition of the feedlot diet (DM basis)

No	Dietary Ingredients	Percentage
	Ammoniated rice straw	
1	Rice straw	100.00
2	NaCl	1.00
3	Urea	3.00
4	Molases	10.00
5	Water	25.00
	Concentrate	
1	Copra meal	5.70
2	Palm kernel cake	24.00
3	Pollard	32.00
4	Cassava waste	28.80
5	Rice bran	7.00
6	Urea	0.80
7	NaCl	0.50
8	CaCO3	0.70
9	NaHCO3	0.20
10	Vitamin + mineral (Premix)	0.20

Table 2. Chemical composition

Item	Ammoniated rice straw	Concentrate
DM (%)	65.00	89.70
Crude protein (%)	5.10	12.30
NDF (%)	78.00	60.00
Fat (%)	0.60	5.20
Ca (%)	0.13	0.50
P (%)	0.05	0.40
ME (MJ/kg)	7.00	10.50

DM : Dry Matter; NDF: Neutral Detergent Fibre;
ME: Metabolishable Energy

The probiotics used in this experiment were *Saccharomyces cerevisae* (2.4 x 10^6 cfu/g) and *Candida utilis* (15 x 10^{11} cfu/g*)* each was added to the diet at a rate of 15 g/head/d. The composition of herbal was: 4% *Curcuma longa* tuber, 4% *Curcuma xanthorrhiza* tuber*,* 4% *Alpina galanga* tuber, 3.2% *Antidesma bunius* leaves*,* 4% *Zingiber aromaticum* tuber, 3.2% *Curcuma longa* leaf, organic Zn (0.17%), organic Cu (0.17%) and rice bran (77.3%).

The composition of organic Zn was soyabean meal (69.4%), ZnSO4 (27.8%) and *S. cerevisae* (2.8%). The composition of organic Cu was soyabean meal (60.4%), CuSO4 (27.8%) and *S. cerevisae* (2.8%). Both of these organic minerals were fermented for 24 days. The herbal was added to the diet at the rate of 125 g/head/d.

Each animal was weighed at the start of fattening and before slaughtering after a 12-h period of fasting. Immediately after slaughtering, the right side was quartered and the hind quarter was dissected into deboned and trimmed commercial joints, following the local butchering procedure.

Chemical analysis

Chemical analyses were done according to AOAC (1990). In-vitro organic matter digestiblilities of ammoniated rice straw and concentrate were determined using the method of Tilley and Terry (1963) to calculate metabolizable energy (ME) content, ME = 0.15% DOM

Meat sample was taken from *longissimus dorsi* between 12^{th} and 13^{th} rib for rib eye area determination and sample of sirloin was taken for proximate analysis and fatty acid composition. Fatty acid analysis was done by High-Performance Liquid Chromatography (HPLC).

Statistical analysis

Comparison between control and treated animals were done using t-test.

Results and Discussion

Live weight gain and dry matter intake

The inclusion of combined probiotics (*Saccharomyces cerevisae* + *Candida utilis*) and herbs in the diet did not affect LWG (Table 3). This might be due to the similarity in DMI of both control and treated buffaloes, however, there was only one value for DMI for treated and control animals since animals in each group were fed together. If the values of DMI were true, then the feed conversion ratios (FCR) were also similar for both control and treated animals. In this experiment the addition of herbs which was supposed to improve appetite did not show the effect on the treated buffaloes. No significant improvement on LWG in animal supplemented with yeast culture were also discovered by Cabrera et al. (2000), Lesmeister et al. (2004), Haddad et al. (2005), Saijpaul et al. (2007), Ramirez et al. (2007), Kawas et al. (2007a), Titi et al. (2008a) and Gomes et al. (2009) although others showed some improvements.

In this study, concentrate was offered at gradual increase up to 90% in the diet. It seemed that the buffaloes in this study had been well adapted with the high concentrate diet. Beauhemin et al. (2003) and Krehbiel et al. (2003) noted that when feedlot cattle are already adapted to high grain diet, despite has low rumen pH, supplementation of direct fed bacterial +/- yeast appears to be of limited value. In this experiment, although rumen pH was not determined, there was no symptom of lactic acidosis being noted in the experimental animals. The supplementation of yeast + herbs was given when the animals were already adapted to the 10:90 ratio of ammonia-treated rice straw: concentrate. Similar explanation may be offered to those studies whereby supplementation of yeast culture had lack of response to animals that had been already adapted to high energy diet. Denev et al. (2007) stated that addition of yeas culture in the diet is less effective when animals are fed well-balanced diets that promote the stability of gastrointestinal microbial population and are more likely to have dramatic effects under conditions of dietary and environmental stress. Therefore, this result calls for consideration of the use of probiotics in feedlot production from the standpoint of improved performance.

Table 3. Observed parameters

Parameters	Control	Treatment
DMI (kg/d)	9.90	10.00
LWG (kg/d)	1.00±0.095 [a]	0.98±0.10 [a]
Carcass (%BW)	44.00±1.39 [a]	46.50±1.06 [a]
Dressing %	48.30±1.63 [a]	50.50±1.30 [a]
Meat (%BW)	25.20±0.71 [a]	23.30±1.40 [a]
Bone (%BW)	6.60±0.32 [b]	9.40±0.36 [a]
Meat:Bone	3.70±0.080 [a]	2.40±0.26 [b]
Body fat (%BW)	6.30±0.16 [a]	5.10±0.25 [b]
Offal (%BW)	9.00±0.37 [a]	7.80±0.45 [b]
By-product (%BW)	30.50±1.04 [a]	30.00±0.34 [a]
Back Fat (mm)	4.80±0.37 [a]	4.60±0.24 [a]
Eye muscle area (cm^2)	60.00±1.65 [a]	57.60±4.72 [a]

Values (in each row) with different subscripts differ significantly (P<0.05)

Carcass composition

Buffaloes supplemented with a combination of probiotics (*Saccharomyces c.* and *Candida u*) + herbs in their diets were not significantly different in percentage of carcass, dressing, commercial cut meat, by-products, back fat and eye muscle area (see Table 3), similar results were also found in the carcass of goats (Whitley et al., 2009), carcass of lambs (Kawas et al., 2007a; Titi et al., 2008), carcass of goat kids (Titi et al., 2008) and carcass of steers (Hinmann et al., 1998 and Gomes et al., 2009) fed commercial dry yeast.

In this experiment, buffaloes fed probiotics + herbs were significantly lower in body fat and offal, and significantly higher in bone percentage than the control. Reduced body fat in probiotic-fed goats was also found by Haryanto (2000), but the opposite result was noted by Titi et al. (2008 a). In this trial, the lower body fat content of treated buffalo may be associated with the decreased triglyceride and cholesterol (both HDL and LDL) as found by Bakr et al. (2009) in buffalo calves supplemented with a combined *Lactobacillus a* and *Saccharomyces c*. Although the percentage of body fat was reduced by yeast + herb

supplementation in the diets, the fat contents (Table 4) and compositions (Table 5). of retail meat (in this case was sirloin) were similar between control and the treated animals. Palmitic and oleic acids comprised the highest proportion of saturated and unsaturated fat in buffalo meat, respectively. This result was comparable to the result found by DiLucia et al. (2003).

Compared to the control, the treated animals showed a reduction in the proportion of offal (Table 3) as the result of reduced weight of intestine, lymph and lung (Table 6). In lambs fed yeast culture, Kawas et al. (2007b) found no effect whereas Titi et al. (2008a) found an increase in gastrointestinal tract. In this study, addition of yeast culture + herbs in the diet resulted in a higher bone percentage (Table 3). Similar result was found by Titi et al. (2008a) in lambs treated with yeast culture but not in goats.

Tabel 4. Water, protein and fat content (%)

Parameters	Control	Treatment
Moisture	66.60±1.93	67.50±1.71
Protein	19.40±1.32	20.10±1.12
Fat	10.4 ±2.15	9.40±1.94

Tabel 5. Fat composition (g/100g)

Parameters	Control	Treatment
Saturated fat	35.10±3.33	40.20±2.57
Capric acid	0.34±0.04	0.35±0.07
Lauric acid	1.02±0.26	0.96±0.26
Miristic acid	5.32±1.04	5.90±0.97
Palmitic acid	23.80±2.42	26.90±0.79
Stearic acid	4.30±1.05	5.10±1.26
Unsaturated fat	57.10±2.69	54.20±2.85
Oleac acid	54.70±1.92	53.10±2.55
Linoleac acid	3.00±1.03	1.30±0.31

The results of probiotic inclusion are always vary. Examination of literatures reveals that the rate of inclusion varies considerably, as does the type of probiotic (bacterial or yeast based or combination), the diet (forage base or grain base or ratio of forage:grain) and the time when the probiotic is given, the animal model being used and also the environment. Furthermore, certain probiotics may produce optimal results at specific points in the growth of animals. All those aspects should be thoroughly examined, in order to obtain more consistent results from probiotic use.

Research on the use of herbal medicine in livestock should also be continued, especially the studies on the content of active compounds and the dose requirement for certain disease prevention or therapy.

Table 6. The offal composition (kg) of buffalo

Parameters	Control	Treatment
Heart	2.50±0.02 ^{a}	2.40±0.18 ^{a}
Liver	5.60±0.44 ^{a}	5.10±0.73 ^{a}
Lung	3.40±0.09 ^{a}	2.80±0.20 ^{b}
Limph	1.50±0.02 ^{a}	0.60±0.08 ^{b}
Renal	2.20±0.09 ^{a}	1.60±0.37 ^{a}
Intestine	11.00±0.45 ^{a}	8.80±0.55 ^{b}
Rumen	11.00±0.45 ^{a}	9.40±0.91 ^{a}

Values (in each row) with different subscripts differ significantly (P<0.05)

Conclusions

Combination of probiotics (*Saccharomyces cerevisae* and *Candida utilis*) + herbs supplementation has little beneficial effect in feedlot buffalo. Results showed no improvement in LWG, percentage of carcass, dressing, meat, by-products, back fat thickness and eye muscle area, increased proportion of bone, reduced meat: bone ratio, and proportion of offal. The only positive effect of the probiotics + herbs was a reduction of body fat, although fatty acid composition was not affected.

References

AOAC. 1990. Official methods of analysis. 14th ed. Assoc. Off. Anal. Chem., Arlington, VA.

Bakr HA, EM Said, MM Abd El-Tawab, MS Hassan. 2009. The impact of probiotic (Biovet) on some clinical, hematological and biochemical parameters in buffalo calves. Beni-Suef Vet. Med. J. 19(1):1 – 10.

Beauchemin KA, WZ Wang, DP Morgavi, GR Ghorbani, W Kautz and JAZ Leedle. 2003. Effects of bacterial-fed microbial and yeast on site and extent of digestion, blood chemistry, and subclinical acidosis in feedlot cattle. J. Anim. Sci. 81:1628 – 1640.

Cabrera EJI, MGD Mendoza, IE Aranda, C Garcia-Bojalili, GR Barcena, JJA Ramos. 2000. *Saccharomyces cerevisae* and nitrogenous supplementation in growing steers grazing tropical pastures. Anim. Feed Sci and Technol. 83(1):49 -55.

Denev SA, T Peeva, P Radulova, P Stancheva, G Staykova, G Beev, P Todorova and S Tchobanova. 2007. Yeast cultures in ruminant nutrition. Bulgarian J. Agric. Sci. 13:357 - 374

Desnoyers M, S Giger-Reverdin, G Bertin, C Duvaux-Ponter and D Sauvant. 2009. Meta-analysis of the influence of *Saccharomyces cerevisae* supplementation on ruminal parameters and milk production of ruminants. J. Dairy Sci. 92:1620 – 1632

DiLuccia A, A Satriani, CMA Baronec, P Catabuglio, S Sigli, M Occidente, E Trivellone, A Zullo and D Matassino. 2003. Effect of dietary energy content on the intramuscular fat depots and triglyceride composition of river buffalo meat. Meat Sci. 65:1379 -1389

Galvao KN, JE Santos, A Coscioni, M Villasenor, WM Sischo, AC Berge. 2005. Effect of feeding live yeast products to calves with failure of passive transfer on performance and patterns of antibiotic resistance in fecal *Escherichia coli*. Reprod. Nut. Dev. 45:427 – 440

Gomes RC, PR Lena, SL Silva, MT Antunes, CF Guedes. 2009. Carcass quality of feedlot finished steers fed yeast, monensin and the association of both additives. Arq. Bras. Med. Vet. Zootec 6 (3):648 - 654

Haddad SG and SN Goussous. 2005. Effect of yeast culture supplementation on nutrient intake, digestibility and growth performance of Awassi lambs. Anim. Feed Sci. and Technol. 118:343 - 348

Haryanto B. 2000. Penggunaan probiotik dalam pakan untuk meningkatkan kwalitas karkas dan daging domba. J. Ilmu Ter. dan Vet. 5(4):224 – 228.

Hinman DD, SJ Sorensen and PA Momont. 1998. Effect of yeast culture on steer performance, apparent diet digestibility and carcass measurements when use in a barley and potato finishing diet. The Prof. Anim. Sci. 14:173- 177.

Kawas JR, R Garcia-Castillob, F Garza-Cazaresa, H Fimbres-Durazob, E Olivares-Saenza, G Hernande-Vidalb and CD Luc. 2007a. Effects of sodium bicarbonate and yeast on production performance and carcass characteristica of light weight lambs fed finishing diet. Small Rum. Resh. 67(2):157 – 163

Kawas JR, R Garcia-Castillo, H Fimbres-Durazo, F Garza-Cazares, JFG Hernández-Vidal, E Olivares-Sáenz, CD Lu. 2007b. Effects of sodium bicarbonate and yeast on nutrient intake, digestibility, and ruminal fermentation of light-weght lambs fed finishing diet. Small Ruminant Res. 67 (2-3):149 - 156

Lesmeister KE, AJ Heinrichs, MT Gabler. 2004. Effects of supplemental yeast (*Saccharomyces cerevisae*) culture on rumen development, growth characteristics, and blood parameters in neonatal dairy calves. J. Dairy Sci. 87:1832-1839

Moallem U, H Lehrer, L Livshitz, M Zachnut and S Ykoby. 2009. The effect of live yeast supplementation to dairy cows during the hot season on production, feed efficiency and digestibility. J. Dairy Sci. 92 343 - 351

Ramirez JF, S Medina and N Garcia. 2007. Effects of the supplementation with yeast (*Saccharomyces cerevisae*) on weight gain and development of water buffalo calves. Italy J. Anim. Sci. 6 (suppl 2):505 -507

Saijpaul S, PK Naik and GS Makar. 2007. Effect of bioboost supplementation on nutrient utilization and performance in buffaloes (*Bubalus bubalis*) calves. Anim. Nut. and Feed Tech. 7(2): short communication

Tilley JMA and RA Terry. 1963. A two-stage technique for the in vitro digestion of forage crops. J. Brit. Grassland So. 18:104

Titi HH, RO Dmour and AY Abdullah. 2008a. Growth performance and carcass characteristics of Awassi lambs and Shami goat kids fed yeast culture in their finishing diet. Anim. Feed. Sci. Tech. 142:33 – 43

Titi HH, AY Abullah, WF Lubbadeh and BS Obeitdah. 2008b. Growth and carcass characteristics of mail dairy calves on a yeast culture supplemented diet. South African J. Anim. Sci. 38 (3):174 -183

Tripathy KK and SA Karim. 2010. Effect of individual and mixed yeast culture feeding on growth performance, nutrient utilization and microbial protein synthesis in lambs. Anim. Feed Sci. and Tech. 155(2):163 – 171

Whitley NC, D Cazac, BJ Rude, D Jackson-O'Crien and S Parveen. 2009. Use of commercial probiotic supplement in meat goats. J. Anim. Sci. 87:723 – 728

Yong H and P Paengkoum. 2009. Supplementation of probiotic on feed intake, digestibility and conjugated linoleic acid content in plasma and meat of growing goats. Agric. J. 4:231 - 241